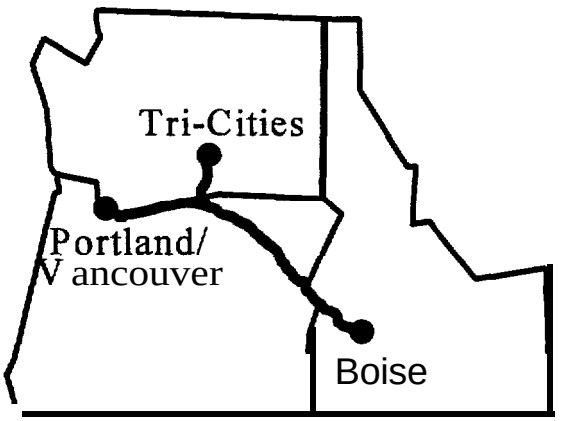
Corridor ITS Strategies
Technical Memorandum
July 1996

Portland/Vancouver to Boise ITS Corridor Study



Prepared for:
Idaho Transportation Department
Oregon Department of Transportation
Washington State Department of Transportation

In Cooperation with:
Federal Highway Administration

[redacted]

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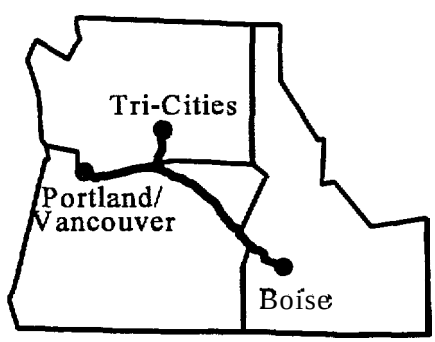
1.0 Project Overview

Intelligent Transportation Systems (ITS) (formerly Intelligent Vehicle Highway Systems [IVHS]) is the application of advanced information processing, communications, vehicle sensing, and traffic control technologies to surface transportation systems. All highway and transit modes, as well as airport access, navigable waterway, and rail can be included in ITS applications. The objective of ITS is to promote more efficient use of the existing highway and transportation network, increase safety and mobility, and decrease environmental impacts due to congestion.

The Portland/Vancouver Washington to Boise, Idaho ITS Corridor Study consists of conducting an Intelligent Transportation System corridor study and developing recommendations for deployment of ITS and appropriate communications technologies along a multi-state, intercity corridor. The corridor limits are defined as follows:

- Interstate 84 from I-205 in Oregon to a point 20 kilometers east of Boise, a distance of 706 kilometers (439 miles).
- Interstate 82 from I-84 in Oregon to I-182 in Tri-Cities, Washington, a distance of 66 kilometers (41 miles).
- State Route 14 from I-205 in Washington to I-82 in Washington, a distance of 282 kilometers (17.5 miles).
- Union Pacific and Burlington Northern Santa Fe Railroads
- Columbia River Waterway



As mentioned, a primary purpose of this project is to develop recommendations for the implementation of appropriate ITS technology to address corridor transportation needs over the next 20 years. The study focuses on specific applications of Advanced Traffic Management Systems, Advanced Traveler Information Systems, Commercial Vehicle Operations, and Advanced Rural Transportation Systems technologies, with an emphasis on providing implementation guidelines that will facilitate the integration and expansion of future ITS components within the corridor.

The planning effort also investigates ways to provide traveler information for various modes. The information, including, but not limited to, current roadway congestion, weather conditions, incident information, and construction information, will be used by travelers to make informed choices regarding mode, route, and time of departure.

The study also investigates the surveillance and communications requirements of traffic management systems and traveler information dissemination. These requirements include incident detection, demand management techniques in urban areas of the corridor, and traffic flow monitoring.

A final purpose is to develop communication recommendations that take into account Idaho Transportation Department (ITD), Oregon Department of Transportation (ODOT), and Washington State Department of Transportation (WSDOT) ITS communication requirements in the corridor. Communication requirements across state borders will receive particular attention.

The ITS implementation and communication plan will be developed for the following time frames:

- Short Term: The first period will encompass the interval from 1997 to 2002. The focus will be on the development of a detailed tactical plan that identifies specific projects and programs to be implemented.
- Medium Term: The second period will include 2003 to 2007. For this time frame, the study will address emerging trends and issues and will recommend steps that ITD, ODOT, and WSDOT should take to prepare for anticipated changes in the transportation operational environment.
- Long Term: The final period will be from 2008 to 2017. The plan will recommend a strategic approach to addressing long-term concerns.

The study is divided into seven major work elements:

Work Element 1- Assess Transportation Needs

This element generally consists of gathering data on transportation and traveler information needs and deficiencies in the corridor and identifying the magnitude of the problems.

Work Element 2 - Identify Corridor ITS Applications

Work Element 2 involves using the US DOT's user services categories to identify which ITS applications have the potential to address corridor needs.

Work Element 3 - Recommend ITS Strategies

This work element will identify ITS strategies that have a clear potential to meet corridor needs. Items associated with individual strategies such as benefits, costs, implementation barriers, technology requirements, and funding will be addressed.

Work Element 4 - Develop Corridor Plan

This element will identify specific projects and programs to be implemented. Short term projects will be developed in sufficient detail to allow them to be included in DOT and other funding and construction programs in the three states,

Work Element 5 - Assess ITS Communications Needs

Work Element 5 will identify the communication characteristics of various ITS field components and make recommendations for a communication system.

Work Element 6 - Conduct Outreach Effort

This work element contains the project's public involvement and outreach program, including stakeholder interviews, general media releases, targeted media kits, workshops, and stakeholder presentations.

Work Element 7 - Prepare Final Report

Work Element 7 will consolidate the results of previous work into a final action plan.

Technical Memorandums will be prepared for each work element, except the outreach effort. Recommendations of the public outreach will be incorporated into other technical memorandums.

2.0 Approach to Work Element 3

The purpose of this technical memorandum is to develop project profiles for each ITS strategy that has a clear potential to address the corridor needs. The profiles address items such as project location, corridor deficiency, potential ITS solution, safety and congestion benefits, technology requirements, implementation barriers, opportunities for public/private partnerships, and estimated time of deployment.

This memorandum also includes a prioritization of the strategies based on meetings with the project stakeholders and the project steering committee.

Section 3.0 discusses compatibility of ITS deployment with state policies and plans**Sections 4.0, 5.0** and **6.0** contain the proposed ITS strategies for each corridor. **Section 7.0** contains system-wide strategies and **Section 8.0** includes a prioritization of the corridor strategies.

3.0 Compatibility With State Policies, Mission, Objectives and Funding

A review of Idaho, Oregon and Washington policy-documents was conducted to identify compatibility between the states' policies, missions, objectives and funding, and with the proposed ITS strategies in the study corridor. The following details the results of the review.

3.1 Idaho

The Idaho Transportation Department is guided by their Strategic Plan which addresses the department's five major program areas: Aeronautics, Motor Vehicles, Public Transportation, Transportation Planning and Highways, and individual, bureau and section plans. As part of the development of the Strategic Plan, the Department's mission, vision, values, and goals were outlined. In general, the mission of the ITD is to provide high quality, cost effective transportation systems that are safe, reliable, and responsible for the economical and efficient movement of people and goods. The following lists ITD objectives from the Strategic Plan that are in harmony with ITS deployment in the study corridor.

Information Systems: To increase the efficiency and effectiveness of the department's technology-based information systems while decreasing costs of operation and maintenance.

Data Communication: To increase ITD's statewide data communications capabilities.

Highway Congestion: To reduce further growth in the percent of congested lane miles on the state highway system.

Public Safety: To reduce the number of deaths and injuries resulting from motor vehicle accidents in Idaho.

Continuous Quality Improvement: To increase the efficiency and cost effectiveness of division programs and activities.

Technology Improvement: To increase the level of technology used by the division.

Employee Development To increase the knowledge, skills, and technological abilities of division personnel.

Departmental Safety: To reduce the average number and severity of departmental accidents.

Motor Carrier Compliance: To improve motor carrier compliance with current statutes, regulations, and permitting processes.

Information To improve access to division-related information.*

Efficiency: To increase the efficiency and cost-effectiveness of data collection and analysis.

Collaboration: To improve collaboration efforts with other states on transportation-related issues.

Public Involvement: To expand the public's access to transportation planning and programming processes.

Electronic Access: To improve the quality and quantity of the communication and data shared electronically with Idaho counties, other agencies, and the public.

3.2 Oregon

Oregon transportation policies, missions, objectives, and funding are contained in Oregon Transportation Plan (OTP). The OTP defines goals, policies, and actions for the state over the next 40 years. It provides direction to the coordination of transportation modes; their relationship of transportation to land use, economic development, the environment, and energy use; the coordination of transportation with federal, state, regional, and local plans; transportation financing; transportation safety and related matters. In summary, the OTP is a guide for the development of a safe, convenient, and efficient transportation system which promotes economic prosperity and livability. The following lists OTP goals and policies that support ITS deployment in the study corridor.

Goal 1: Characteristics of the System
To enhance Oregon's quality of life and comparative economic advantage by provision of a transportation system with the following characteristics:

- Balance
- Efficiency
- Accessibility
- Environmental Responsibility
- Connectivity among Modes and Carriers
- Safety
- Financial Stability

Policy 1A - Balance
It is the policy of the State of Oregon to provide a balanced transportation system. A balanced transportation system is one that provides transportation options at appropriate minimum service standards, reduces reliance on single occupant automobile where other modes or choices can be made available, particularly in urban areas, and takes advantage of the inherent efficiencies of each mode.

Policy 1B - Efficiency
It is the policy of the State of Oregon to assure provision of an efficient transportation system. The system is efficient when (1) it is fast and economic for the user; and (2) users face prices that reflect the full costs of their transportation choices; and (3) transportation investment decisions maximize the net full benefits of the system. (Full benefits and costs include social and environmental impacts, as well as the benefits of mobility to users, and construction, operations and maintenance costs.)

Policy 1D - Environmental Responsibility
It is the policy of the State of Oregon to provide a transportation system that is environmentally responsible and encourages conservation of natural resources.

Policy 1E - Connectivity among Places
It is the policy of the State of Oregon to identify and develop a statewide transportation system of corridors and facilities that ensures appropriate access to all areas of the state, nation, and the world.

Policy lF- Connectivity among Modes and Carriers
It is the policy of the State of Oregon to provide a transportation system with connectivity among modes within and between urban areas, with ease of transfer among modes and between local and state transportation systems.

Policy 1G - Safety
It is the policy of the State of Oregon to improve continually the safety of all facets of statewide transportation for system users including operators, passengers, pedestrians, recipients of goods and services, and property owners.

Goal 2: Livability
To develop a multimodal transportation system that provides access to the entire state, supports acknowledged comprehensive land use plans, is sensitive to regional differences, and supports livability in urban and rural areas.

Policy 2A - Land Use
It is the policy of the State of Oregon to develop transportation plans and policies that implement Oregon's Statewide Planning Goals, as adopted by the Land Conservation and Development Commission.

Policy 2C - Relationshin of Interurban and Urban Mobility
It is the policy of the State of Oregon to provide interurban mobility through and near urban areas in a manner which minimizes adverse effects on land use and urban travel patterns.

Policy 2F- Rural Mobility
It is the policy of the State of Oregon to facilitate the movement of goods and services and to improve access in rural areas.

Goal 3: Economic Development
To promote the expansion and diversity of Oregon's economy through the efficient and effective movement of goods, services, and passengers in a safe, energy efficient, and environmentally sound manner.

Policy 3A - Balanced and Efficient Freight System
It is the policy of the State of Oregon to promote a balanced freight transportation system which takes advantage of the inherent efficiencies of each mode.

Policy 3B - Linkages to Market
It is the policy of the State of Oregon to assure effective transportation linkages for goods and passengers to attract a larger share of international and interstate trade to the state.

Policy 3E - Tourism
It is the policy of the State of Oregon to develop a transportation system that supports intrastate, interstate, and international tourism and improves access to recreational destinations.

Goal 4: Implementation
To implement the Transportation Plan by creating a stable but flexible financing system, by using good management practices, by supporting transportation research and technology, and by working cooperatively with federal, regional, and local governments, Indian tribal governments, the private sector, and citizens.

Policy 4B - Efficient and Effective Improvements
It is the policy of the State of Oregon to develop and maintain a transportation finance structure that promotes funding by the state and local governments of the most appropriate improvements in a given situation and promotes the most efficient and effective operation of the Oregon transportation system.

Policy 4F - Equity
It is the policy of the State of Oregon to develop a transportation finance system which consciously attempts to provide equity among competing users, payers, beneficiaries, providers of the transportation system, and regions of the state.

Policy 4G - Management Practices
It is the policy of the State of Oregon to manage effectively existing transportation infrastructure and services before adding new facilities.

Policy 4H - Research and Technology Transfer
It is the policy of the State of Oregon to promote the development of innovative management practices, technologies and regulatory techniques and safety measures that will further implementation of the Oregon Transportation Plan and lead to new approaches to meeting mobility needs.

3.3 Washington

The mission, goals, and policies for the WSDOT are contained in the Statewide Multimodal Transportation Plan. The plan addresses transportation facilities including state highways, the Washington State Ferry System, and state owned airports. It also addresses facilities not owned by the state including public transportation, freight rail, intercity passenger rail, marine ports, non-motorized transportation, and aviation. The planning is intended to ensure that Washington's transportation system provides convenient, reliable, safe, efficient, and seamless connections and services to all modes of transportation. A major part of the plan is the State Highway Plan, which deals the most directly with the corridor study. The following lists objectives and strategies from the State Highway Plan that are supportive of ITS technologies.

Highway Maintenance Program M
Maintain state highways on a daily basis to ensure safe, reliable, and pleasant movement of people and goods.

1. Minimize travel delay time due to emergency conditions.
2. Provide safe winter travel on highways that remain open to public.
4. Maintain visibility of traffic control and safety devices.

Highway Transportation Systems Management, Program Q
Operate the highway transportation system safely and efficiently.

1. Coordinate system operations to address regional and statewide priorities.
2. Increase freeway efficiency through use of surveillance, control, and driver information (SC&DI) systems and quick incident response.
3. Improve overall system efficiency through coordinated traffic signal systems and advance technology testing and deployment, i.e., Intelligent Transportation Systems (ITS).
4. Partner with stakeholders to address questions and concerns, and develop solutions for system operational issues.
5. Implement consistent statewide traffic design and operations policy, specifications, training, and regulations.

Highway Preservation Programs. P1, P2, P3

Preserve the highway infrastructure cost effectively to protect the public investment.

1. Stabilize known unstable slopes.
3. Construct weight facilities to ensure enforcement across the entire highway system.

Mobility. Program 11

Improve mobility within congested highway corridors.

3. Provide uncongested conditions (Level of Service C) on rural highways.
4. Mitigate congestion on urban highways in cooperation with local and regional jurisdictions when the peak period level of service falls below Level of Service D.

Safety. Program I2

Provide the safest possible highways within available resources.

1. Improve highway sections that have a high accident history.
3. Improve roadways where geometrics, traffic volumes, and speed limits indicate a high accident potential.

Economic Initiatives. Program 13

Support efficient and reliable freight movement on state highways.

4. Where cost effective, replace or modify structures that cannot carry legal overloads.

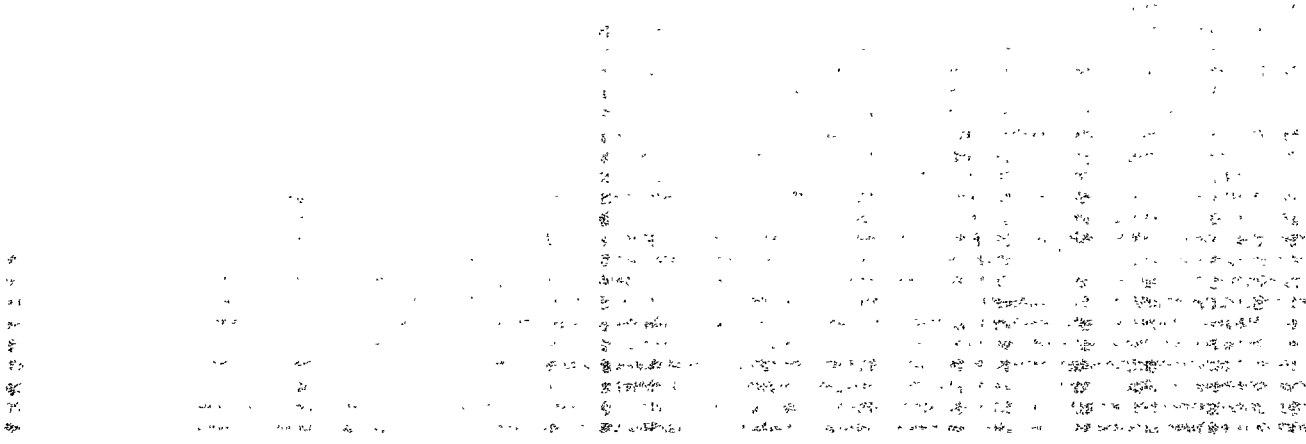
Support tourism development and other Washington industries.

1. Ensure public access to appropriately sized, rest room equipped facilities every 60 miles on the National Highway System (NHS), and Scenic and Recreational (S&R) highways.
3. Cooperatively promote and interpret the heritage resources along S&R highways, including providing incentives for alternatives to outdoor advertising.

Preserve, restore, enhance, and maintain the heritage resources along scenic and recreational (S&R) highways. where appropriate, within state-owned rights of way and easements, and cooperatively with communities and agencies for heritage resources of state-interest outside state-owned rights of way, as identified in Corridor Management Plans.

1. S&R highways will be addressed as a specific element in the Route and Roadside Development planning implementation process.
2. Provide and maintain appropriate multimodal access, both physical and visual, to heritage resources and recreational opportunities along S&R highways, including increased access for nontraditional users.

3. Develop a statewide network of traveler information (i.e., facilities, services, and other media) along or accessible from S&R highways.
4. Cooperatively secure revenues to match and stimulate additional funding through partnerships with public and private sources for transportation projects which preserve, enhance, restore. and maintain heritage resources and access to recreational opportunities.



4.0 I-84 Strategies

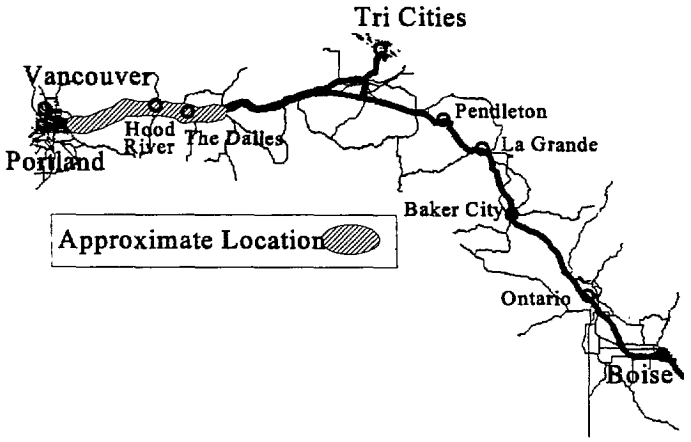
Strategies for the I-84 corridor primarily focus on addressing the significant weather problems that occur on a regular basis, including ice, snow, high winds, and fog. Strategies also focus on corridor needs related to urban and rural congestion locations, overuse at tourist attractions, high accident areas, roadway closures and diversions, and increased interagency coordination.

4.1 Road Weather Information System in Columbia River Gorge

Route Name: I-84
Direction: Eastbound/Westbound
Beginning Mile Post: 17 OR
Ending Mile Post: 104 OR

Corridor Deficiency

Rain, snow, and ice related accidents in this section are well above the average rate for the corridor. Weather related problems, including high wind and fog require the freeway to be closed several times during the year. Closures may range from an hour to more than a day. There is a need for better weather and roadway information.



ITS Solution

Deploy road weather information system (RWIS) sites in this section of the freeway. These stations will assist road maintenance crews in deciding when plowing, sanding, or deicing chemicals should be implemented, as well as if travel should be restricted due to inclement weather, wind, or poor visibility. Weather stations could be spaced as close as five to seven miles in areas with the greatest weather and accident problems. Equipment could be spaced much further apart in other areas. The stations may monitor humidity, temperature, wind, precipitation, ice conditions on bridges and shadow areas, and visibility. As part of the RWIS, include low-cost, "still frame" video equipment to verify the weather conditions. The video image would assist people in determining the type of precipitation and the visibility. Make the information available to maintenance personnel at their maintenance facilities and at homes with a personal computer and pagers. Make information available to the general public through the Internet, Variable Message Signs (VMS), kiosks, Highway Advisory Radio (HAR) and Highway Advisory Telephone (HAT). Information to the public should also include details about construction and maintenance activities in the corridor.

Safety Benefits

- RWIS sites will assist ODOT personnel in determining when weather related maintenance needs to be implemented, such as application of sanding or deicing chemicals when pavement temperature falls below freezing.
- Allows faster and more accurate notification on weather conditions. Provides more efficient use of staff resources.
- The general public benefits by having real time information to make travel decisions.
- Reduced accidents are expected.

Congestion Benefits

- If this information is conveyed in a timely manner to motorists, vehicles are less likely to travel in parts of the corridor with hazardous conditions.
- Roadside assistance calls and travel delays could be reduced.

Technology Requirements

- Weather stations
- Electrical service
- Communications with weather stations and kiosks
- Low cost "still frame" video cameras
- Traveler kiosks

Implementation Barriers

- Some initial setup is required to determine the optimal time when roadway maintenance should be performed.
- Columbia River Gorge Commission will need to approve the installations.
- States will need to agree to share information obtained with their systems.
- Adjacent states should have the ability to view weather information throughout the corridor.
- Important weather information should be "pushed" to other states to allow for timely information transfer. If the data is transferred only when requested from a neighboring state, the data may be too outdated to be useful.

Opportunities for Public/Private Partnership

- Windsurfer advisories might be sponsored by suppliers of windsurfing equipment.
- Traveler information service may be able to partner with private advertising.
- Major private destinations in the Columbia River Gorge, such as ski resorts, and local chambers of commerce may be willing to contribute resources to support implementation.
- ODOT may receive free communications channels for this project for providing longitudinal use of the corridor right-of-way by telecommunications companies.
- May be opportunities to partner with cellular service providers to allow free calls to the weather information system.
- State may want to cooperatively fund expansion of cellular coverage in the study corridor in exchange for free call service from cellular providers.
- Mt. Hood ski areas may be interested to use the information to encourage skiers to use 1-84, when other routes such as Highway 26 have poor driving conditions.
- Freight transportation brokers, truckers' associations, or freight alliances may be interested in contributing funds/effort to get real-time information about conditions along the corridor, as a service to their members.
- Input weather/condition information/data may be available/ coordinated with private or other public weather stations in the area.

Estimated Time of Deployment

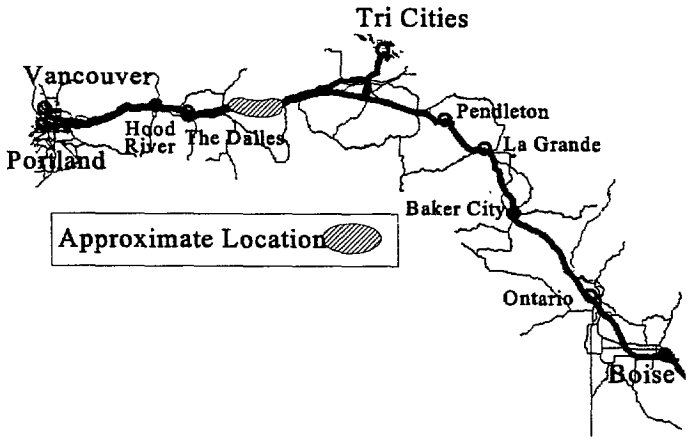
Short term: 1997 - 2002

4.2 Road Weather Information System West of Biggs Junction

Route Name: I-84
Direction: Eastbound/Westbound
Beginning Mile Post: 104 OR
Ending Mile Post: 120 OR

Corridor Deficiency

Rain, snow, and ice related accidents in some parts if this section are well above the average rate for the corridor. Weather related problems, including high wind and fog require the freeway to be closed several times during the year. Closures may range from an hour to more than a day. There is a need for better weather and roadway information.



ITS Solution

Deploy road weather information system (RWIS) sites in this section of the freeway. These stations will assist road maintenance crews in deciding when plowing, sanding, or deicing chemicals should be implemented, as well as if travel should be restricted due to inclement weather, wind, or poor visibility. The stations may monitor humidity, temperature, wind, precipitation, ice conditions on bridges and shadow areas, and visibility. As part of the RWIS, include low-cost, "still frame" video equipment to verify the weather conditions. The video image would assist people in determining the type of precipitation and the visibility. Make the information available to maintenance personnel at their maintenance facilities and at homes with a personal computer and pagers. Make information available to the general public through the Internet, Variable Message Signs (VMS), kiosks, Highway Advisory Radio (HAR), and Highway Advisory Telephone (HAT). Information to the public should also include details about construction and maintenance activities in the corridor. *As part of ODOT's Green Light project, the state is planning to deploy a RWIS system in this section near Biggs Junction. No video equipment is currently planned for this location.*

Safety Benefits

- RWIS sites will assist ODOT personnel in determining when weather related maintenance needs to be implemented, such as application of sanding or deicing chemicals when pavement temperature falls below freezing.
- Allows faster and more accurate notification on weather conditions. Provides more efficient use of staff resources.
- The general public benefits by having real time information to make travel decisions.
- Reduced accidents are expected.

Congestion Benefits

- If this information is conveyed in a timely manner to motorists, vehicles are less likely to travel in parts of the corridor with hazardous conditions.
- Roadside assistance calls and travel delays could be reduced.

Technology Requirements

- Weather stations
- Electrical service
- Communications with weather stations and kiosks
- Low cost "still frame" video cameras
- Traveler kiosks

Implementation Barriers

- Some initial setup is required to determine the optimal time when roadway maintenance should be performed.
- States will need to agree to share information obtained with their systems.
- Adjacent states should have the ability to view weather information throughout the corridor.
- Important weather information should be "pushed" to other states to allow for timely information transfer. If the data is transferred only when requested from a neighboring state, the data may be too outdated to be useful.

Opportunities for Public/Private Partnership

- Windsurfer advisories might be sponsored by suppliers of windsurfing equipment.
- Traveler information service may be able to partner with private advertising.
- Major private destinations and local chambers of commerce may be willing to contribute resources to support implementation.
- ODOT may receive free communications channels for this project for providing longitudinal use of the corridor right-of-way by telecommunications companies.
- May be opportunities to partner with cellular service providers to allow free calls to the weather information system.
- State may want to cooperatively fund expansion of cellular coverage in the study corridor in exchange for free call service from cellular providers.
- Freight transportation brokers, truckers' associations, or freight alliances may be interested in contributing funds/effort to get real-time information about conditions along the corridor, as a service to their members.
- Input weather/condition information/data may be available/coordinated with private or other public weather stations in the area.

Estimated Time of Deployment

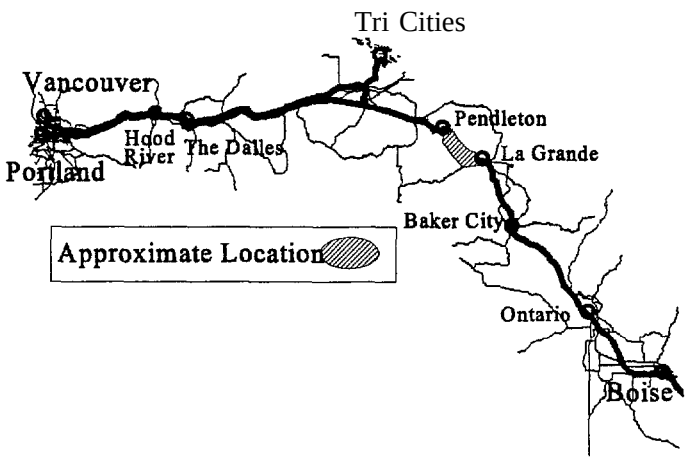
Short term: 1997 - 2002

4.3 Road Weather Information System in Blue Mountains

Route Name: I-84
Direction: Eastbound/Westbound
Beginning Mile Post: **210** OR
Ending Mile Post: **260** OR

Corridor Deficiency

Rain, snow, and ice related accident rates in this section are among the highest for the corridor. Weather related problems, including high wind and fog require the freeway to be closed several times during the year. Problems are compounded by steep grades at the ends of this section, as well as icy sections of the roadway and bridges that are blocked from sun exposure by trees and hillsides. Closures may range from an hour to more than a day. There is a need for better weather and roadway information.



ITS Solution

Deploy road weather information system (RWIS) sites in this section of the freeway. These stations will assist road maintenance crews in deciding when plowing, sanding, or deicing chemicals should be implemented, as well as if travel should be restricted due to inclement weather, wind, or poor visibility. The stations may monitor humidity, temperature, wind, precipitation, ice conditions on bridges and shadow areas, and visibility. Weather stations could be spaced as close as five to seven miles in areas with the greatest weather and accident problems. Equipment could be spaced much further apart in other areas. As part of the RWIS, include low-cost, "still frame" video equipment to verify the weather conditions. The video image would assist people in determining the type of precipitation and the visibility. Make the information available to maintenance personnel at their maintenance facilities and at homes with a persona1 computer and pagers. Make information available to the general public through the Internet, Variable Message Signs (VMS), kiosks, Highway Advisory Radio (HAR), and Highway Advisory Telephone (HAT). Information to the public should also include details about construction and maintenance activities in the corridor.

Safety Benefits

- RWIS sites will assist ODOT personnel in determining when weather related maintenance needs to be implemented, such as application of sanding or deicing chemicals when pavement temperature falls below freezing.
- Allows faster and more accurate notification on weather conditions. Provides more efficient use of staff resources.
- The general public benefits by having real time information to make travel decisions.

- Reduced accidents are expected.

Congestion Benefits

- If this information is conveyed in a timely manner to motorists, vehicles are less likely to travel in parts of the corridor with hazardous conditions.
- Roadside assistance calls and travel delays could be reduced.

Technology Requirements

- Weather stations
- Electrical service
- Communications with weather stations and kiosks
- Low cost "still frame" video cameras
- Traveler kiosks

Implementation Barriers

- Some initial setup is required to determine the optimal time when roadway maintenance should be performed.
- The rural nature of the corridor may create difficulty in providing electrical and communication services to the equipment sites.
- States will need to agree to share information obtained with their systems.
- Adjacent states should have the ability to view weather information throughout the corridor.
- Important weather information should be "pushed" to other states to allow for timely information transfer. If the data is transferred only when requested from a neighboring state, the data may be too outdated to be useful.

Opportunities for Public/Private Partnership

- Traveler information service may be able to partner with private advertising.
- Major private destinations and local chambers of commerce may be willing to contribute resources to support implementation.
- ODOT may receive free communications channels for this project for providing longitudinal use of the corridor right-of-way by telecommunications companies.
- May be opportunities to partner with cellular service providers to allow free calls to the weather information system.
- State may want to cooperatively fund expansion of cellular coverage in the study corridor in exchange for free call service from cellular providers.
- Freight transportation brokers, truckers' associations, or freight alliances may be interested in contributing funds/effort to get real-time information about conditions along the corridor, as a service to their members.
- Input weather/condition information/data may be available/coordinated with private or other public weather stations in the area.

Estimated Time of Deployment

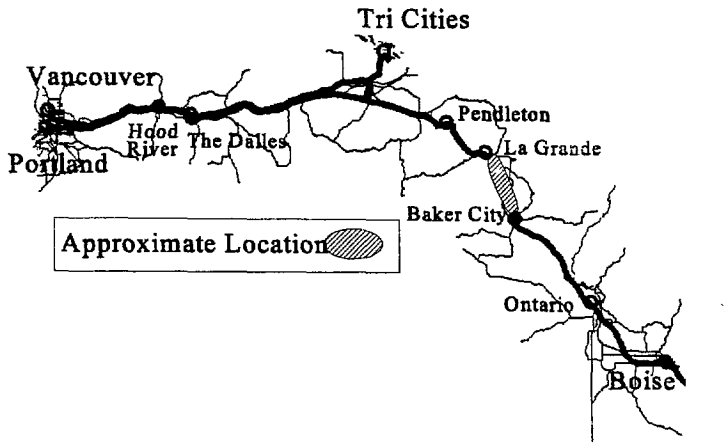
Short term: 1997 - 2002

4.4 Road Weather Information System in Ladd Canyon

Route Name: I-84
Direction: Eastbound/Westbound
Beginning Mile Post: 262 OR
Ending Mile Post: 304 OR

Corridor Deficiency

Rain, snow, and ice related accidents in some parts of this section are well above the average rate for the corridor, particularly on the Ladd Canyon grade east of La Grande. Weather related problems, interfere with travel in this corridor and occasionally require the closure of the roadway. Closures may range from an hour to more than a day. There is a need for better weather and roadway information.



ITS Solution

Deploy road weather information system (RWIS) sites in this section of the freeway. These stations will assist road maintenance crews in deciding when plowing, sanding, or deicing chemicals should be implemented, as well as if travel should be restricted due to inclement weather, wind, or poor visibility. The stations may monitor humidity, temperature, wind, precipitation, ice conditions on bridges and shadow areas, and visibility. As part of the RWIS, include low-cost, "still frame" video equipment to verify the weather conditions. The video image would assist people in determining the type of precipitation and the visibility. Make the information available to maintenance personnel at their maintenance facilities and at homes with a personal computer and pagers. Make information available to the general public through the Internet, Variable Message Signs (VMS), kiosks, Highway Advisory Radio (HAR), and Highway Advisory Telephone (HAT). Information to the public should also include details about construction and maintenance activities in the corridor. *As part of ODOT's Green Light project, the state may deploy a RWIS system in this section between La Grande and Baker City. No video equipment is currently planned for this location.*

Safety Benefits

- RWIS sites will assist ODOT personnel in determining when weather related maintenance needs to be implemented, such as application of sanding or deicing chemicals when pavement temperature falls below freezing.
- Allows faster and more accurate notification on weather conditions. Provides more efficient use of staff resources.
- The general public benefits by having real time information to make travel decisions.
- Reduced accidents are expected.

Congestion Benefits

- If this information is conveyed in a timely manner to motorists, vehicles are less likely to travel in parts of the corridor with hazardous conditions.
- Roadside assistance calls and travel delays could be reduced.

Technology Requirements

- Weather stations
- Electrical service
- Communications with weather stations and kiosks
- Low cost "still frame" video cameras
- Traveler kiosks

Implementation Barriers

- Some initial setup is required to determine the optimal time when roadway maintenance should be performed.
- States will need to agree to share information obtained with their systems.
- Adjacent states should have the ability to view weather information throughout the corridor.
- Important weather information should be "pushed" to other states to allow for timely information transfer. If the data is transferred only when requested from a neighboring state, the data may be too outdated to be useful.

Opportunities for Public/Private Partnership

- Traveler information service may be able to partner with private advertising.
- Major private destinations and local chambers of commerce may be willing to contribute resources to support implementation.
- ODOT may receive free communications channels for this project for providing longitudinal use of the corridor right-of-way by telecommunications companies.
- May be opportunities to partner with cellular service providers to allow free calls to the weather information system.
- State may want to cooperatively fund expansion of cellular coverage in the study corridor in exchange for free call service from cellular providers.
- Freight transportation brokers, truckers' associations, or freight alliances may be interested in contributing funds/effort to get real-time information about conditions along the corridor, as a service to their members.
- Input weather/condition information/data may be available/coordinated with private or other public weather stations in the area.

Estimated Time of Deployment

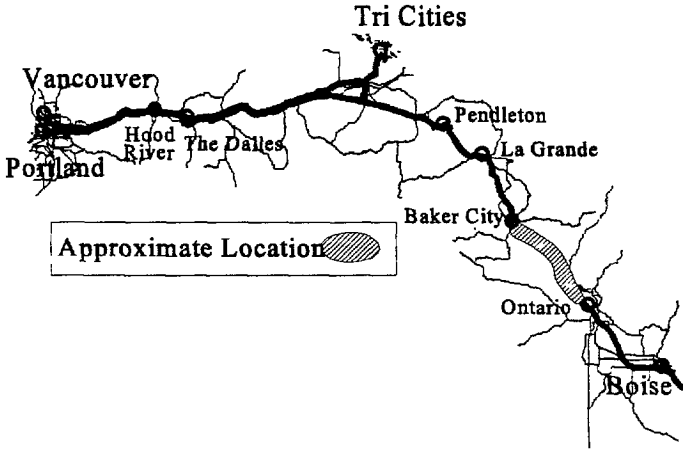
Short term: 1997 - 2002

4.5 Road Weather Information System, Baker City to Ontario

Route Name: I-84
Direction: Eastbound/Westbound
Beginning Mile Post: 304 OR
Ending Mile Post: 376 OR

Corridor Deficiency

Rain, snow, and ice related accidents in this section are well above the average rate for the corridor. Weather related problems occasionally require the freeway to be closed. Problems are compounded by steep grades, substandard curves, and icy sections of the roadway and bridges that are blocked from sun exposure by trees and hillsides. There is a need for better weather and roadway information.



ITS Solution

Deploy several road weather information system (RWIS) sites in this section of the freeway. These stations will assist road maintenance crews in deciding when plowing, sanding, or deicing chemicals should be implemented, as well as if travel should be restricted due to inclement weather, wind, or poor visibility. The stations may monitor humidity, temperature, wind, precipitation, ice conditions on bridges and shadow areas, and visibility. Weather stations could be spaced as close as five to seven miles in areas with the greatest weather and accident problems. Equipment could be spaced much further apart in other areas. As part of the RWIS, include low-cost, "still frame" video equipment to verify the weather conditions. The video image would assist people in determining the type of precipitation and the visibility. Make the information available to maintenance personnel at their maintenance facilities and at homes with a personal computer and pagers. Make information available to the general public through the Internet, Variable Message Signs (VMS), kiosks, Highway Advisory Radio (HAR) and Highway Advisory Telephone (HAT). Information to the public should also include details about construction and maintenance activities in the corridor.

Safety Benefits

- RWIS sites will assist ODOT personnel in determining when weather related maintenance needs to be implemented, such as application of sanding or deicing chemicals when pavement temperature falls below freezing.
- Allows faster and more accurate notification on weather conditions. Provides more efficient use of staff resources.
- The general public benefits by having real time information to make travel decisions.
- Reduced accidents are expected.

Congestion Benefits

- If this information is conveyed in a timely manner to motorists, vehicles are less likely to travel in parts of the corridor with hazardous conditions.
- Roadside assistance calls and travel delays could be reduced.

Technology Requirements

- Weather stations
- Electrical service
- Communications with weather stations and kiosks
- Low cost "still frame" video cameras
- Traveler kiosks

Implementation Barriers

- Some initial setup is required to determine the optimal time when roadway maintenance should be performed.
- The rural nature of the corridor may create difficulty in providing electrical and communication services to the equipment sites.
- States will need to agree to share information obtained with their systems.
- Adjacent states should have the ability to view weather information throughout the corridor.
- Important weather information should be "pushed" to other states to allow for timely information transfer. If the data is transferred only when requested from a neighboring state, the data may be too outdated to be useful.

Opportunities for Public/Private Partnership

- Traveler information service may be able to partner with private advertising.
- Major private destinations and local chambers of commerce may be willing to contribute resources to support implementation.
- ODOT may receive free communications channels for this project for providing longitudinal use of the corridor right-of-way by telecommunications companies.
- State may want to cooperatively fund expansion of cellular coverage in the study corridor in exchange for free call service from cellular providers.
- May be opportunities to partner with cellular service providers to allow free calls to the weather information system.
- Freight transportation brokers, truckers' associations, or freight alliances may be interested in contributing funds/effort to get real-time information about conditions along the corridor, as a service to their members.
- Input weather/condition information/data may be available/coordinated with private or other public weather stations in the area.

Estimated Time of Deployment

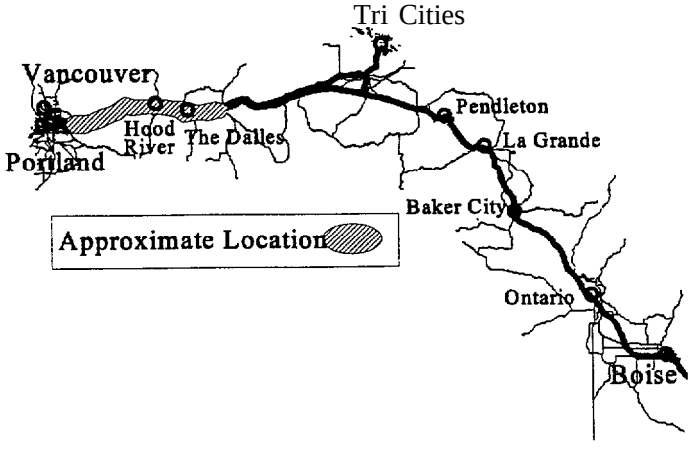
Short term: 1997 - 2002

4.6 VMS Deployment in Columbia River Gorge

Route Name: I-84
Direction: Eastbound, Westbound
Beginning Mile Post: 17 OR
Ending Mile Post: 104 OR

Corridor Deficiency

Rain, snow, and ice related accidents in this section are well above the average rate for the corridor. Weather related problems, including slides, rock falls, high wind and fog require the freeway to be closed several times during the year. Sometimes traffic must be diverted to SR 14 in Washington. Closures or diversions may range from an hour to more than a day. There is a need for better weather and roadway information, as well as more efficient management of the roadway during incidents.



ITS Solution

Deploy variable message signs (VMS) connected to the road weather information system (RWIS). Use the VMS to convey weather information, road closures, construction information, maintenance activities, and traffic diversions to motorists. In the summer when weather related problems diminish, VMS equipment could be used to notify drivers of congestion associated with tourist attractions such as Multnomah Falls. Tie the operation to a central location where congestion, incidents, and other roadway information can be coordinated between the three states. VMS equipment should be located in advance of river crossings for maximum benefit to handle diversions. VMS operation could be relatively automated but may overridden manually if needed. Remote VMS terminals could be allowed to control the sign messages as long as users have system authorization and the message conforms to the priority protocol. As state police begin outfitting patrol vehicles with computers, officers can provide real-time information regarding weather, closures, and diversions. It may be desirable to use the VMS to indicate to drivers the estimated length of the time to clear the incident, thus allowing drivers to alter their schedule or route.

Safety Benefits

- Motorists will be better informed about hazardous weather conditions and can adjust their driving accordingly.
- Accidents in the corridor are expected to decrease.
- Fewer law enforcement personnel are required to implement a closure or diversion.

Congestion Benefits

- VMS can alert drivers of congestion, construction information, maintenance activities, and incidents, thus allowing drivers to select alternate routes.
- Congestion can be reduced.

Technology Requirements

- VMS and Controllers
- Communications with the VMS equipment
- Electrical service

Implementation Barriers

- Would require staffing of the central location to use the VMS for incident and congestion management.
- Operational strategies for the use of VMS during traffic incidents, diversions, congestion, etc. would be needed, including coordination between ODOT and WSDOT.
- Columbia River Gorge Commission will need to approve the installations.
- Potential liability issue if RWIS automatically controls the VMS. Message priority system is essential.

Opportunities for Public/Private Partnership

- ODOT may receive free communications channels for this project for providing longitudinal use of the corridor right-of-way by telecommunications companies.
- Freight transportation brokers, truckers' associations, or freight alliances may be interested in contributing funds/effort to get real-time information about conditions along the corridor, as a service to their members.
- Input weather/condition information/data may be available/coordinated with private or other public weather stations in the area.

Estimated Time of Deployment

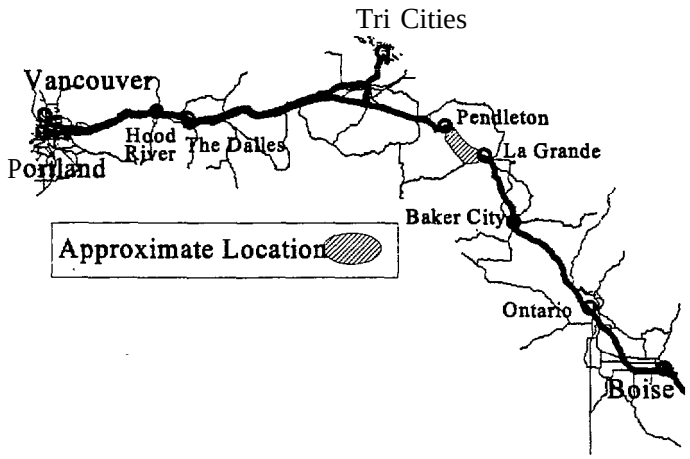
Short term: 1997 - 2002

4.7 VMS Deployment in Blue Mountains

Route Name: **I-84**
Direction: Eastbound, Westbound
Beginning Mile Post: **2 10** OR
Ending Mile Post: **263** OR

Corridor Deficiency

Rain, snow, and ice related accident rates in this section are among the highest for the corridor. Weather related problems, including high wind and fog require the freeway to be closed several times during the year. Problems are compounded by steep grades at the ends of this section, as well as icy sections of the roadway and bridges that are blocked from sun exposure by trees and hillsides. Closures may range from an hour to more than a day. There is a need for better weather and roadway information, as well as more efficient management of the roadway during incidents.



ITS Solution

Deploy variable message signs (VMS) connected to the road weather information system (RWIS). Use the VMS to convey weather information, construction information, maintenance activities, and road closures to motorists. Tie the operation to a central location and use the signs to also provide information on congestion, incidents, and other roadway information. Coordinate the information between the three states. VMS operation could be relatively automated but may be overridden manually if needed. Remote VMS terminals could be allowed to control the sign messages as long as users have system authorization and the message conforms to the priority protocol. As state police begin outfitting patrol vehicles with computers, officers can provide real-time information regarding weather, closures, and diversions. It may be desirable to use the VMS to indicate to drivers the estimated length of the time to clear the incident, thus allowing drivers to alter their schedule or route.

Safety Benefits

- Motorists will be better informed about hazardous weather conditions and can adjust their driving accordingly.
- Accidents in the corridor are expected to decrease. Fewer law enforcement personnel are required to implement a closure.
- Given the remoteness of this area, few opportunities are available for traffic diversions.

Congestion Benefits

- VMS can alert drivers of incidents, construction information, maintenance activities, and resulting congestion.
- Congestion can be reduced.

Technology Requirements

- VMS and Controllers
- Communications with the VMS equipment
- Electrical service

Implementation Barriers

- Would require staffing of the central location to use the VMS for incident and congestion management.
- Operational strategies for the use of VMS during traffic incidents, diversions, congestion, etc. would be needed, including coordination Between ODOT and WSDOT.
- The weather information from the RWIS could be automated.
- Potential liability issue if RWIS automatically controls the VMS. Message priority system is essential.

Opportunities for Public/Private Partnership

- ODOT may receive free communications channels for this project for providing longitudinal use of the corridor right-of-way by telecommunications companies.
- Freight transportation brokers, truckers' associations, or freight alliances may be interested in contributing funds/effort to get real-time information about conditions along the corridor, as a service to their members.
- Input weather/condition information/data may be available/coordinated with private or other public weather stations in the area.

Estimated Time of Deployment

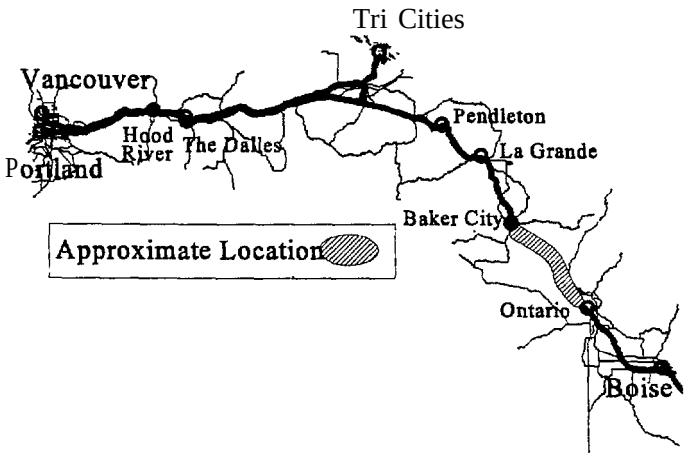
Short term: 1997 - 2002

4.8 VMS Deployment, Baker City to Ontario

Route Name: I-84
Direction: Eastbound, Westbound
Beginning Mile Post: **303** OR
Ending Mile Post: 375 OR

Corridor Deficiency

Rain, snow, and ice related accident rates in this section are well above the average for the corridor. Weather related problems occasionally require the freeway to be closed during the year. Problems are compounded by steep grades at the ends of this section. There is a need for better weather and roadway information, as well as more efficient management of the roadway during incidents.



ITS Solution

Deploy variable message signs (VMS) connected to the road weather information system (RWIS). Use the VMS to convey weather information and road closures to motorists. Tie the operation to a central location and use the signs to also provide information on congestion, incidents, construction information, maintenance activities, and other roadway information. Coordinate the information between the three states. VMS operation could be relatively automated but may be overridden manually if needed. Remote VMS terminals could be allowed to control the sign messages as long as users have system authorization and the message conforms to the priority protocol. As state police begin outfitting patrol vehicles with computers, officers can provide real-time information regarding weather, closures, and diversions. It may be desirable to use the VMS to indicate to drivers the estimated length of the time to clear the incident, thus allowing drivers to alter their schedule or route.

Safety Benefits

- Motorists will be better informed about hazardous weather conditions and can adjust their driving accordingly.
- Accidents in the corridor are expected to decrease.
- Fewer law enforcement personnel are required to implement a closure or diversion.

Congestion Benefits

- VMS can alert drivers of congestion, construction information, maintenance activities, and incidents, thus allowing drivers to select alternate routes.
- Congestion can be reduced.

Technology Requirements

- VMS and Controllers
- Communications with the VMS equipment
- Electrical service

Implementation Barriers

- Would require staffmg of the central location to use the VMS for incident and congestion management.
- Operational strategies for the use of VMS during traffic incidents, diversions, congestion, etc. would be needed.
- Columbia River Gorge Commission will need to approve the installations.
- The weather information from the RWIS could be automated.
- Potential liability issue if RWIS automatically controls the VMS. Message priority system is essential.

Opportunities for Public/Private Partnership

- ODOT may receive free communications channels for this project for providing longitudinal use of the corridor right-of-way by telecommunications companies.
- Freight transportation brokers, truckers' associations, or freight alliances may be interested in contributing funds/effort to get real-time information about conditions along the corridor, as a service to their members.
- Input weather/condition information/data may be available/coordinated with private or other public weather stations in the area.

Estimated Time of Deployment

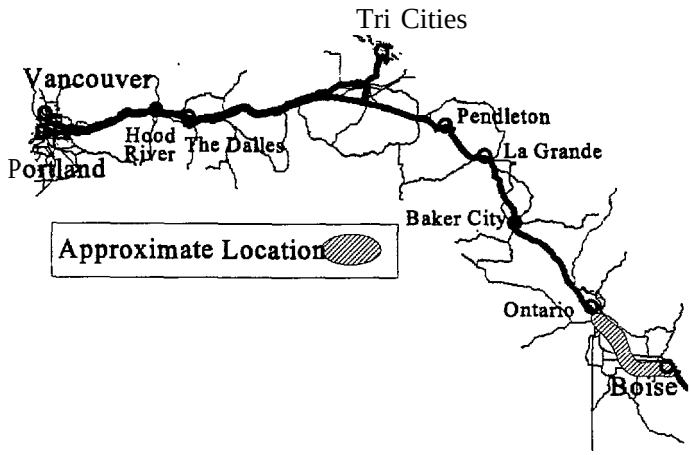
Short term: 1997 - 2002

4.9 VMS Deployment in Idaho

Route Name: I-84
Direction: Eastbound, Westbound
Beginning Mile Post: **0** ID
Ending Mile Post: 60 ID

Corridor Deficiency

Accidents, from the Idaho/Oregon border to east of Boise, are far above the I-84 average rate. Weather and congestion contribute to the elevated accident levels.



ITS Solution

Deploy variable message signs (VMS) connected to the existing road weather information system (RWIS) sites and planned. Use the VMS to convey weather information, construction information, maintenance activities, incidents, and diversions to motorists. Tie the operation to a central location and use the signs to also provide information on congestion, incidents, and other roadway information. VMS operation could be relatively automated but may be overridden manually if needed. Remote VMS terminals could be allowed to control the sign messages as long as users have system authorization and the message conforms to the priority protocol. If state police outfit patrol vehicles with computers as is being done on Oregon and Washington, officers can provide real-time information regarding weather, closures, and diversions. It may be desirable to use the VMS to indicate to drivers the estimated length of the time to clear the incident, thus allowing drivers to alter their schedule or route.

Safety Benefits

- Motorists will be better informed about hazardous weather conditions and can adjust their driving accordingly.
- Accidents in the corridor are expected to decrease.

Congestion Benefits

- VMS can alert drivers of congestion, construction information, maintenance activities, and incidents, thus allowing drivers to select alternate routes.
- Congestion can be reduced.

Technology Requirements

- VMS and Controllers
- Communications with the VMS equipment
- Electrical service

Implementation Barriers

- Would require staffing of the central location to use the VMS for incident and congestion management.
- Operational strategies for the use of VMS during traffic incidents, diversions, congestion, etc. would be needed.
- The weather information from the RWIS could be automated.
- Potential liability issue if RWIS automatically controls the VMS. Message priority system is essential.

Opportunities for Public/Private Partnership

- ITD may receive free communications channels for this project for providing longitudinal use of the corridor right-of-way by telecommunications companies.
- Freight transportation brokers, truckers' associations, or freight alliances may be interested in contributing funds/effort to get real-time information about conditions along the corridor, as a service to their members.
- Input weather/condition information/data may be available/coordinated with private or other public weather stations in the area.

Estimated Time of Deployment

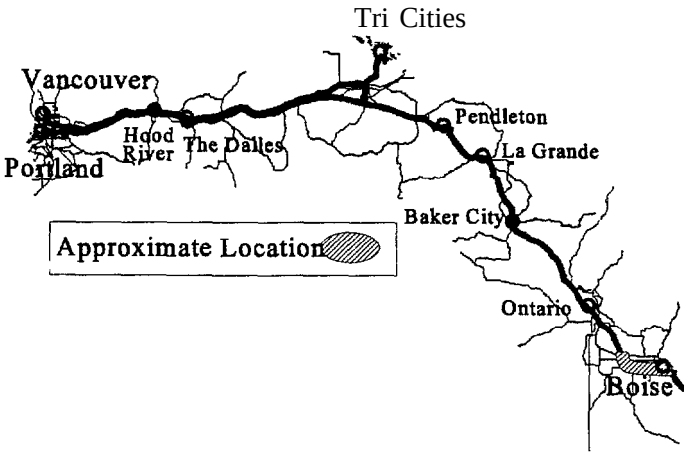
Short term: 1997 - 2002

4.10 Advanced Transportation Management System (ATMS) in Boise

Route Name: I-84
Direction: Eastbound, Westbound
Beginning Mile Post: **36** ID
Ending Mile Post: *60* ID

Corridor Deficiency

Corridor congestion in the Boise area was identified as a transportation problem. Recurring congestion and random incidents disrupt freeway operations on a daily basis. At some locations, overloaded interchanges force traffic queues onto the freeway, thus interfering with mainline flow. Although much of I-84 is being reconstructed in the metro area, rapid population and employment growth will likely cause the freeway to operate below acceptable levels. Accident rates through Boise are among the highest for the entire I-84 corridor.



ITS Solution

Conduct an ATMS feasibility study to determine if ITS technology is an appropriate method for dealing with congestion. Study the feasibility for deployment of incident detection, ramp metering, variable message signs, closed circuit television, automated emergency services notification, highway advisory radio, and other ITS technologies. Evaluate opportunities to coordinate with arterial traffic signal systems that interface with I-84. *Recent discussions within ITD and other local transportation forums have identified the need for an ATMS in the Boise area.*

Safety Benefits

- Traffic flow would be smoothed through ramp metering and VMS notification of congestion, thus reducing the potential of congestion related accidents.
- Rapid detection and response to incidents would reduce the likelihood of secondary accidents.

Congestion Benefits

- Metering the traffic entering the mainline, allows for more stable flows and reduced congestion.
- Incident detection and management will minimize will minimize delays and congestion.

Technology Requirements

Could include:

- Vehicle detection
- Variable Message Signs
- Closed Circuit Television
- Highway Advisory Radio
- Communication system
- Electrical service
- Computer System

Implementation Barriers

- Would require staffing of a central location to operate the system for incident and congestion management.

Opportunities for Public/Private Partnership

- ITD could potentially exchange access to the right of way for telecommunications access to support the ATMS.
- ITD may find support for ATMS components from the trucking industry. Freight transportation brokers, truckers associations, or freight alliances may provide resources to assist in implementation as a service to their members.

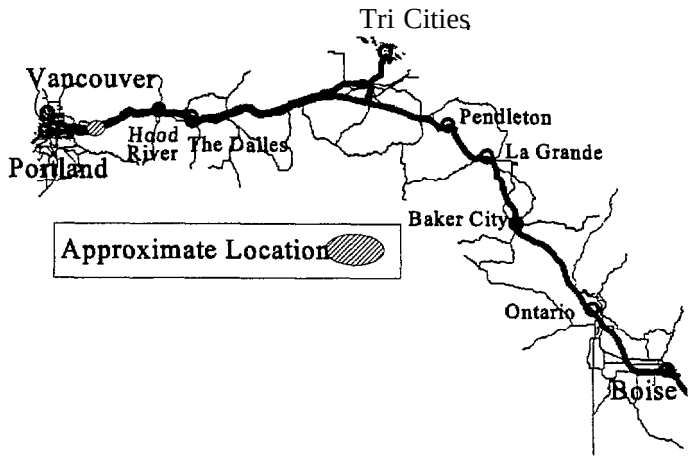
Estimated Time of Deployment

Short term: 1997 - 2002 ATMS study and deployment

4.11 Parking Management System at Multnomah Falls

Route Name: I-84
Direction: Eastbound, Westbound
Beginning Mile Post: 26 OR
Ending Mile Post: 370R

Corridor Deficiency



Multnomah Falls is a significant recreational attraction in Oregon. During the peak tourist season, the parking lot located between the eastbound and westbound lanes on I-84 is often filled to capacity. Frequently, drivers park on the ramp shoulders creating a safety hazard for vehicles entering the parking lot and occasionally for vehicles on the main line. Expanding the parking lot is not an option due to restrictions on the number of visitors the site can accommodate at one time. Drivers need to know when the parking lot is full so that they can bypass the site and possibly visit other nearby scenic attractions.

ITS Solution

Electronically monitor the status of the parking lot and activate a VMS to notify drivers that spaces are not available. Locate signs in advance of the eastbound Bridal Veil (MP 28) exit and the westbound Dodson (MP 35) exit to allow drivers to leave the freeway and visit other area attractions. This could help the Columbia River Gorge National Scenic Area Management Plan by directing visitors away from this area to similar recreational opportunities in less used areas of the Gorge. Implement a cellular phone number that drivers can call to check on real-time parking conditions at the Falls.

Safety 'Benefits

- Overloading of the parking lot will be diminished.
- The potential for accidents will be reduced.
- Having the VMS equipment located in advance of exits to the historic Columbia River Highway will allow drivers to alter their travel plans before reaching the Falls parking lot and finding there are no available parking spaces.

Congestion Benefits

- Parking lot congestion will be reduced.

Technology Requirements

- Small VMS, or blankout sign with controller
- Vehicle detectors
- Electrical service
- Communication link

Implementation Barriers

- Columbia River Gorge Commission will need to approve the installations.
- Will need to provide highly accurate, real-time information to ensure driver confidence.
- May need to use gates to prevent vehicles from entering the lot when full. Without a physical barrier, some drivers may enter the lot regardless if the sign indicates the lot is full.

Opportunities for Public/Private Partnership

- ODOT could potentially exchange access to the right of way for telecommunications access to support the parking management system.
- Possible advertising in conjunction with the cellular phone service.

Estimated Time of Deployment

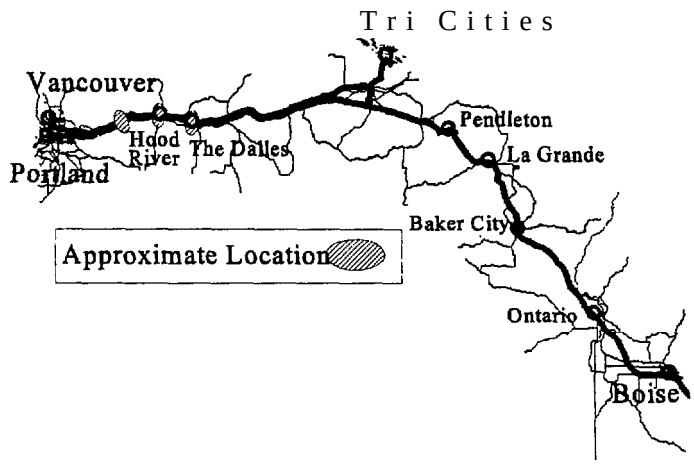
Short term: 1997 - 2002

4.12 Truck Overweight and Oversize Detectors for Columbia River Bridges

Route Name: Cascade Locks, Hood River, and The Dalles Bridges
Direction: Northbound, Southbound
I-84 Mile Post: Cascade Locks - MP 44
Hood River - MP 64
The Dalles - MP 87

Corridor Deficiency

Bridges over the Columbia River at Cascade Locks, Hood River, and The Dalles are not designed to accommodate overweight and oversized trucks. There is a need to detect trucks that exceed the design limits of the bridges before they begin crossing. This is particularly important when closures of I-84 or SR 14 divert all traffic over one of these bridges. The likelihood is low that the bridges will be reconstructed to provide adequate strength and size.



ITS Solution

Deploy truck weight, height, and width detectors near the approaches to the three bridges. Have the detectors activate a warning sign well in advance of the bridge to alert truckers that they cannot use the bridge.

Safety Benefits

- System will minimize the potential of trucks causing damage to the bridges.

Congestion Benefits

- Will reduce the potential for having a truck get stuck on the bridge and blocking traffic.

Technology Requirements

- Weight, height, and width detectors
- Small VMS, blankout sign, and flashing beacon
- Communications with the equipment
- Electrical service

Implementation Barriers

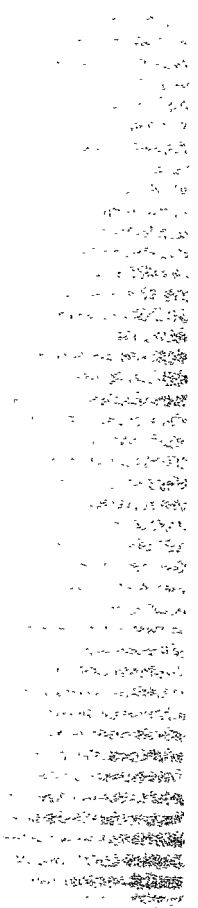
- Constraints near the approaches to the bridges may make it difficult to find a suitable location to place the detectors.
- Once detected, the trucks need a way to divert away from the bridge without backing up.

Opportunities for Public/Private Partnership

- Freight transportation brokers, truckers associations or freight alliances may provide resources to implement overweight and oversize detectors on bridges as a service to their members.

Estimated Time of Deployment

Short term: 1997 - 2002



5.0 I-82 Strategies

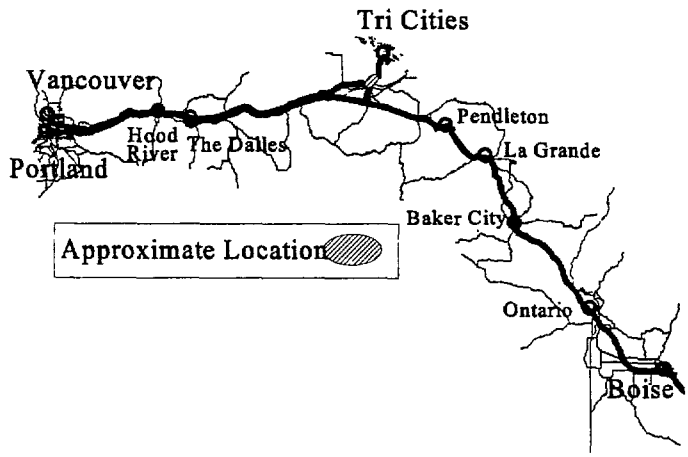
Strategies for the I-82 corridor focus on addressing weather problems, commercial vehicle operations, and the need to integrate existing ITS equipment in a corridor-wide system to notify drivers of conditions on I-84 and SR 14.

5.1 Automated Port of Entry and Mainline Commercial Vehicle Pre-Clearance

Route Name: I-82
Direction: Westbound
Beginning Mile Post: 121
Ending Mile Post: 121

Corridor Deficiency

The need for more efficient processing of commercial vehicles was identified previously. Oregon and Idaho have deployed automated weigh facilities; however the Washington port-of-entry is not fully automated. Weigh-in-motion (WIM) scales currently exist but the P.O.E. should be upgraded to the same level as the Oregon and Idaho locations.



ITS Solution

Supplement the WIM by deploying mainline pre-clearance systems, automatic classification, overheight detectors, VMS, and database management to streamline CVO processing at this location. Essentially implement a system that is similar and compatible to the Oregon system which includes VISION technology by using cameras to read Public Utilities Commission license plates.

Safety Benefits

- Helps prevent trucks from queuing at the scales back towards the main line I-82.
- Systems can automatically verify vehicle safety information.
- Driver's hours of service can also be checked.
- Trucks or drivers not meeting safety requirements can be removed from the roadway.
- Increased vehicle/driver safety compliance is expected to reduce accidents involving trucks.

Congestion Benefits

- Commercial vehicles can be weighed and cleared on the mainline.
- Time and cost savings for commercial vehicles

Technology Requirements

- Weigh-in-motion equipment
- Automatic vehicle identification equipment
- Overheight detectors
- Automatic vehicle identification

- Variable message signs
- VISION equipment
- Communications with equipment

Implementation Barriers

- Compatibility between systems operated in Oregon and Washington

Opportunities for Public/Private Partnership

None identified

Estimated Time of Deployment

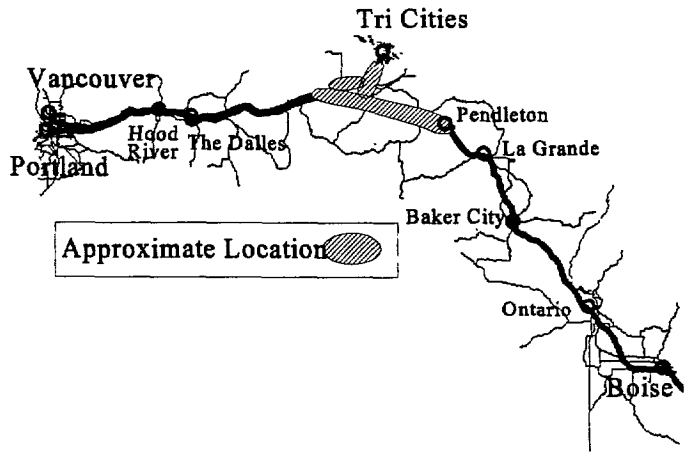
Shortterm: **1997 -2002**

5.2 VMS Integration Near Umatilla

Route Name: I-84, I-82, SR 14
Direction: Eastbound, Westbound
Beginning Mile Post: Varies
Ending Mile Post: Varies

Corridor Deficiency

Although accidents and weather problems are generally not a significant problem in this area, there is a need for traveler information. More than 10 VMS already exist in this relatively small geographic area. The signs were installed as part of a warning system for the Umatilla Army Depot where large stockpiles of chemical weapons are stored. ODOT occasionally uses the signs via a computer terminal but they are not integrated into a corridor system. Eventually the Army plans to incinerate the chemicals and then turn over the VMS to ODOT. Incineration of the weapons is expected to be completed sometime after 2004.



ITS Solution

Integrate the existing Umatilla Army Depot variable message signs (VMS) to convey information regarding weather conditions, road closures, traffic diversions, construction projects, and maintenance activities to motorists. Tie the operation to a central location and use the signs to also provide information on congestion, incidents, closures, diversions, and other roadway information. As more signs are installed for the Army near the Tri-Cities area, integrate them into the system.

Safety Benefits

- Motorists will be better informed about hazardous weather conditions and can adjust their driving accordingly.
- Accidents in the corridor are expected to decrease.
- Fewer law enforcement personnel are required to implement a closure or diversion.

Congestion Benefits

- VMS can alert drivers of congestion and incidents, thus allowing drivers to select alternate routes.
- Congestion can be reduced.

Technology Requirements

- VMS and Controllers
- Communications with the VMS equipment

Implementation Barriers

- Would require staffing of a central location to use the VMS for incident and congestion information.
- Oregon and Washington will both need access to the system and will need a Memorandum of Understanding with the Army to jointly operate the system.
- Operational strategies for the use of VMS during traffic incidents, diversions, congestion, etc. would be needed, including coordination between ODOT and WSDOT.
- The weather information from the RWIS could be relatively automated.

Opportunities for Public/Private Partnership

- ODOT and WSDOT may receive free communications channels for this project for providing longitudinal u se of the corridor right-of-way by telecommunications companies.
- Freight transportation brokers, truckers' associations, or freight alliances may be interested in contributing funds/effort to get real-time information about conditions along the corridor, as a service to their members.
- Input weather/condition information/data may be available/coordinated with private or other public weather stations in the area.

Estimated Time of Deployment

Short term: 1997 - 2002

6.0 SR 14 Strategies

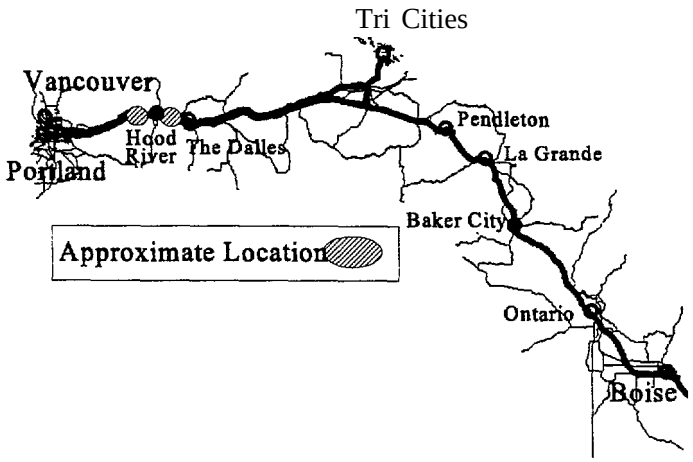
Like the I-84 corridor, strategies for the SR 14 corridor primarily focus on addressing the significant weather problems that occur on a regular basis, including ice, snow, high winds, and fog. Strategies also focus on corridor needs related to urban and rural congestion locations, overuse of tourist attractions, high accident areas, roadway closures and diversions, rock slide areas, narrow tunnels, and increased interagency coordination.

6.1 Rockfall Detection System

Route Name: SR 14
Direction: Eastbound, Westbound
Beginning: To be determined
Endign Mile Post: To be determined

Corridor Deficiency

Rock slides and unstable slopes are a considerable problem along the western half of SR 14. Some slope stabilization has been implemented but the Columbia River Gorge National Scenic Area Management Plan prevents aggressive stabilization through conventional means. As a result, rocks and other debris frequently fall to the roadway creating a safety hazard and occasionally forcing the closure of the roadway.



ITS Solution

Implement a rockfall detection system in a test location along SR 14. Consider locations with WSDOTs highest instability rating such as near MP 54 and MP 77. Detectors could activate a sign, beacon, or VMS to alert motorists of the danger. Rockfall occurrences should be transmitted to maintenance and police personnel. If the system proves reliable, implement similar equipment at other locations with a high instability rating.

Safety Benefits

- Drivers can be alerted in advance of the debris on the roadway.
- Accidents resulting from rock slides are expected to decrease.

Congestion Benefits

- Maintenance personnel can respond quickly to the problem and expedite cleanup, thus reducing delay to motorists.

Technology Requirements

- Small VMS, or blankout sign with controller
- Rockfall detector
- Communications with the equipment
- Electrical service

Implementation Barriers

- Detection of rocks and debris is difficult; however emerging technologies such as video imaging and acoustic detectors may be able to accurately identify when rock falls have occurred.

Opportunities for Public/Private Partnership

- Potentially exchange access to the right of way for telecommunications access and/or equipment.
- Detection manufacturers may be willing to participate in a test as a means of developing a new market for their equipment.

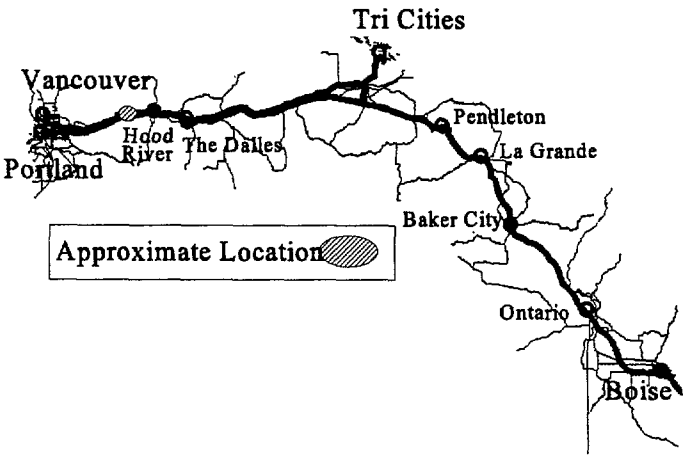
Estimated Time of Deployment

Medium term: 2003 - 2007

6.2 Truck Detectors for Tunnels

Route Name: SR 14
Direction: Eastbound, Westbound
Beginning Mile Post: 58 WA
Ending Mile Post: 60 WA

Corridor Deficiency



Five narrow tunnels between Bonneville and Bingen, WA have height restrictions. Sight distances are also limited approaching the tunnels due to poor horizontal alignment of the roadway. When trucks enter the tunnels they frequently drive in the center of the roadway where the tunnel ceiling is the highest, thus increasing the potential for accidents. Opposing vehicles enter the tunnel and become surprised to find a large truck in their lane. Accidents in this area are 150% above the total accident rate for the corridor. Warning signs with flashing beacons are already being used at the tunnels to warn drivers when bicycles are in the tunnels. Bicycle warning signs are activated by a pushbutton at each tunnel entrance. The likelihood is low that the tunnels will be reconstructed to provide adequate width and height.

ITS Solution

Provide real-time enroute driver information to increase awareness of the potential for conflict in the tunnels. Install signs with beacons in advance of the tunnel portals to alert drivers when large vehicles are in the tunnels. Signs could also be used to warn of bicycles. A truck height detector would be required to activate the sign.

Safety Benefits

- Driver awareness will be increased about the potential for conflict in the tunnels.
- If the signs are only activated when a problem exist, drivers are more likely to react to the situation and use increased caution.
- Accidents are expected to decrease.

Congestion Benefits

No direct congestion benefits are expected.

Technology Requirements

- Small VMS, or blankout sign with controller
- Truck height detector

- Bicycle detector
- Electrical service (existing)

Implementation Barriers

- Columbia River Gorge Commission will need to approve the installations.

Opportunities for Public/Private Partnership

- Freight transportation brokers, truckers' associations or freight alliances may provide resources to implement overweight and oversize detectors on bridges as a service to their members.

Estimated Time of Deployment

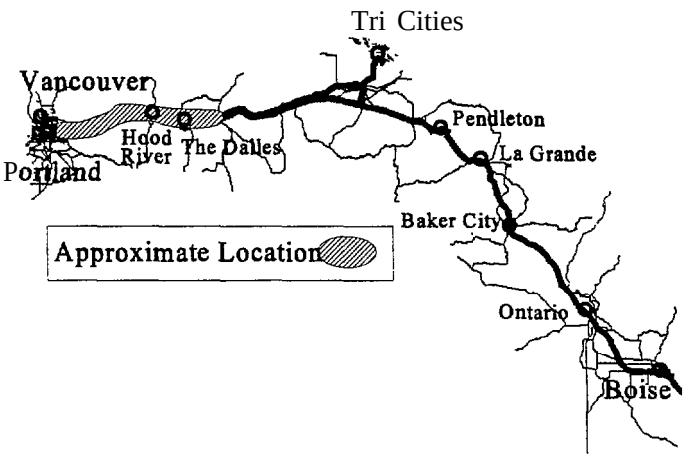
Short term: 1997 - 2002

6.3 Road Weather Information System in Columbia River Gorge

Route Name: SR 14
Direction: Eastbound/Westbound
Beginning Mile Post: 12 WA
Endign Mile Post: 101 WA

Corridor Deficiency

Rain, snow, and ice related accidents in this section are well above the average rate for the corridor. Weather related problems, including slides, rock falls, high wind and fog interfere with traffic movement and occasionally require the roadway to be closed during the year. Sometimes traffic must be diverted to I-84 in Oregon. Closures or diversions may range from an hour to more than a day. There is a need for better weather and roadway information.



ITS Solution

Deploy road weather information system (RWIS) sites in this section of the highway. These stations will assist road maintenance crews in deciding when plowing, sanding, or deicing chemicals should be implemented, as well as if travel should be restricted due to inclement weather, wind, or poor visibility. Weather stations could be spaced as close as five to seven miles in areas with the greatest weather and accident problems. Equipment could be spaced much further apart in other areas. The stations may monitor humidity, temperature, wind, precipitation, ice conditions on bridges and shadow areas, and visibility. As part of the RWIS, include low-cost, "still frame" video equipment to verify the weather conditions. The video image would assist people in determining the type of precipitation and the visibility. Make the information available to maintenance personnel at their maintenance facilities and at homes with a personal computer and pagers. Make information available to the general public through the Internet, kiosks, Highway Advisory Radio (HAR), and Highway Advisory Telephone (HAT). Information to the public should also include details about construction and maintenance activities in the corridor.

Safety Benefits

- RWIS sites will assist WSDOT personnel in determining when weather related maintenance needs to be implemented, such as application of sanding or deicing chemicals when pavement temperature falls below freezing.
- Allows faster and more accurate notification on weather conditions. Provides more efficient use of staff resources.
- The general public benefits by having real time information to make travel decisions.
- Reduced accidents are expected.

Congestion Benefits

- If this information is conveyed in a timely manner to motorists, vehicles are less likely to travel in parts of the corridor with hazardous conditions.
- Roadside assistance calls and travel delays could be reduced.

Technology Requirements

- Weather stations
- Electrical service
- Communications with weather stations and kiosks
- Low cost "still frame" video cameras
- Traveler kiosks

Implementation Barriers

- Some initial setup is required to determine the optimal time when roadway maintenance should be performed.
- Columbia River Gorge Commission will need to approve the installations.
- States will need to agree to share information obtained with their systems.
- Adjacent states should have the ability to view weather information throughout the corridor.
- Important weather information should be "pushed" to other states to allow for timely information transfer. If the data is transferred only when requested from a neighboring state, the data may be too outdated to be useful.

Opportunities for Public/Private Partnership

- Windsurfer advisories might be sponsored by suppliers of windsurfing equipment.
- Traveler information service may be able to partner with private advertising.
- Major private destinations in the Columbia River Gorge and local chambers of commerce may be willing to contribute resources to support implementation.
- WSDOT may receive free communications channels for this project for providing longitudinal use of the corridor right-of-way by telecommunications companies.
- May be opportunities to partner with cellular service providers to allow free calls to the weather information system.
- State may want to cooperatively fund expansion of cellular coverage in the study corridor in exchange for free call service from cellular providers.
- Freight transportation brokers, truckers' associations, or freight alliances may be interested in contributing funds/effort to get real-time information about conditions along the corridor, as a service to their members.
- Input weather/condition information/data may be available/coordinated with private or other public entity stations in the area.

Estimated Time of Deployment

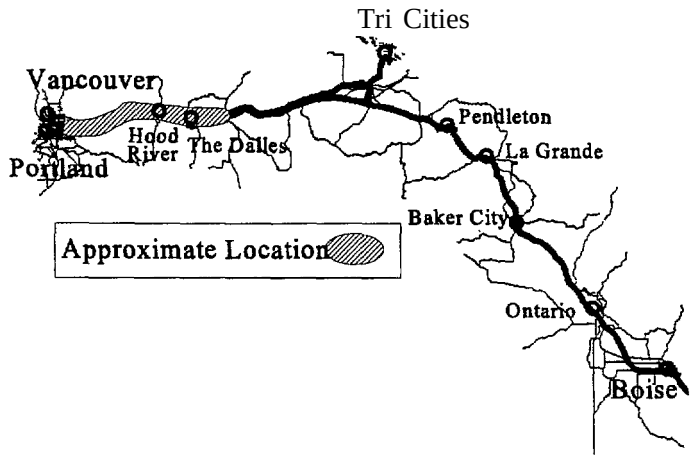
Short term: 1997 - 2002

6.4 VMS Deployment in Columbia River Gorge

Route Name: SR 14
Direction: Eastbound, Westbound
Begining Mile Post: 12 WA
Enging Mile Post: 101 WA

Corridor Deficiency

Rain, snow, and ice related accidents in this section are well above the average rate for the corridor. Weather related problems, including slides, rock falls, high wind and fog interfere with traffic movement and occasionally require the roadway to be closed during the year. Sometimes traffic must be diverted to I-84 in Oregon. Closures or diversions may range from an hour to more than a day. There is a need for better weather and roadway information, as well as more efficient management of the roadway during incidents.



ITS Solution

Deploy variable message signs (VMS) connected to the road weather information system (RWIS) sites. Use the VMS to convey weather information, road closures, construction information, maintenance activities, and traffic diversions to motorists. In the summer when weather related problems diminish, VMS equipment could be used to notify drivers of congestion associated with tourist attractions such as windsurfing locations near Bingen. Tie the operation to a central location where congestion, incidents, and other roadway information can be coordinated between the three states. VMS equipment should be located in advance of river crossings for maximum benefit. VMS operation could be relatively automated but may be overridden manually if needed. Remote VMS terminals could be allowed to control the sign messages as long as users have system authorization and the message conforms to the priority protocol. As state police begin outfitting patrol vehicles with computers, officers can provide real-time information regarding weather, closures, and diversions. It may be desirable to use the VMS to indicate to drivers the estimated length of the time to clear the incident. thus allowing drivers to alter their schedule or route.

Safety Benefits

- Motorists will be better informed about hazardous weather conditions and can adjust their driving accordingly.
- Accidents in the corridor are expected to decrease.
- Fewer law enforcement personnel are required to implement a closure or diversion.

Congestion Benefits

- VMS can alert drivers of congestion, construction information, maintenance activities, and incidents, thus allowing drivers to select alternate routes.
- Congestion can be reduced.

Technology Requirements

- VMS and Controllers
- Communications with the VMS equipment
- Electrical service

Implementation Barriers

- Would require Staffing of the central location to use the VMS for incident and congestion management.
- Operational strategies for the use of VMS during traffic incidents, diversions, congestion, etc. would be needed, including coordination between ODOT and WSDOT.
- Columbia River Gorge Commission will need to approve the installations.
- The weather information from the RWIS could be automated.
- Potential liability issue if RWIS automatically controls the VMS. Message priority system is essential.

Opportunities for Public/Private Partnership

- WSDOT may receive free communications channels for this project for providing longitudinal use of the corridor right-of-way by telecommunications companies.
- Freight transportation brokers, truckers' associations, or freight alliances may be interested in contributing funds/effort to get real-time information about conditions along the corridor, as a service to their members.
- Input weather/condition information/data may be available/coordinated with private or other public weather stations in the area.

Estimated Time of Deployment

Short term: 1997 - 2002

7.0 Corridor-Wide Strategies

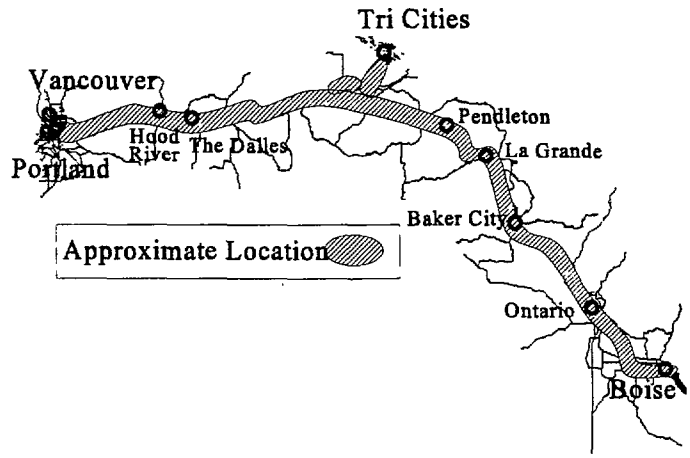
Some strategies are intended for the entire corridor and are focused on methods to convey traveler information to motorists. Strategies also include methods to integrate and coordinate information and technology between the three states.

7.1 Highway Advisory Radio Deployment in Corridor

Route Name: I-84, I-82, SR 14
Direction: Eastbound, Westbound
Beginning Mile Post: N/A
Ending Mile Post: N/A

Corridor Deficiency

Rain, snow, and ice related accident rates are a problem in many locations in the corridor. Other weather related problems, including high wind and fog sometimes require the freeway to be closed during the year. VMS equipment is highly effective at alerting drivers of roadway conditions but it is not capable of transmitting lengthy messages. There is a need to provide more real-time weather and roadway information to motorists. Some weather data is available from commercial stations located in the corridor but most motorists don't want to wait for long periods of time to get the information.



ITS Solution

Deploy Highway Advisory Radio equipment (HAR) near VMS locations. The VMS can alert drivers to the general problem and then drivers can tune to the HAR to obtain greater details regarding the roadway segment ahead. Messages could be automatically generated by the RWIS or created manually when necessary. In the long term eventually, convert the HAR system to a Radio Broadcast Data System (RBDS) where digital messages are directly sent to vehicles through a FM sideband signal carried by a local radio station. With this technology, messages regarding accidents, weather problems, closures, etc. can be sent to RBDS radios regardless of the receiver's operational mode. Although this technology is relatively new to America, nearly 90% of vehicles in Europe have radios that can receive the digital messages. At this time only about 1 million vehicles in America have RBDS radios but car manufacturers are planning to include them as standard equipment. By 1998, General Motors plans to include them in all their vehicles. *Development of RBDS in America is ongoing. If the technology is sufficiently developed by the time HAR deployment is expected in the corridor, it may be desirable to immediately deploy RBDS without installing HAR as a precursor system.*

Safety Benefits

- Motorists will be better informed about hazardous weather conditions and can adjust their driving accordingly.
- Accidents in the corridor are expected to decrease.

- Fewer law enforcement personnel are required to implement a closure.

Congestion Benefits

- HAR can notify drivers of congestion and incidents.
- Congestion can be reduced.

Technology Requirements

- HAR Transmitter
- Communications with the HAR and RWIS
- Electrical service

Implementation Barriers

- Drivers must have the ability to know when a message is available.
- The information must be timely.
- There is a need for a central site to monitor and create messages.
- HAR equipment has limited transmitting power of 10 watts, thus range is only 5 - 10 miles.
- States acceptance of advertising on HAR.

Opportunities for Public/Private Partnership

- Restaurants, motels, gas stations, and truck stops could partner to help pay for installations in exchange for advertising spots on the HAR.

Estimated Time of Deployment

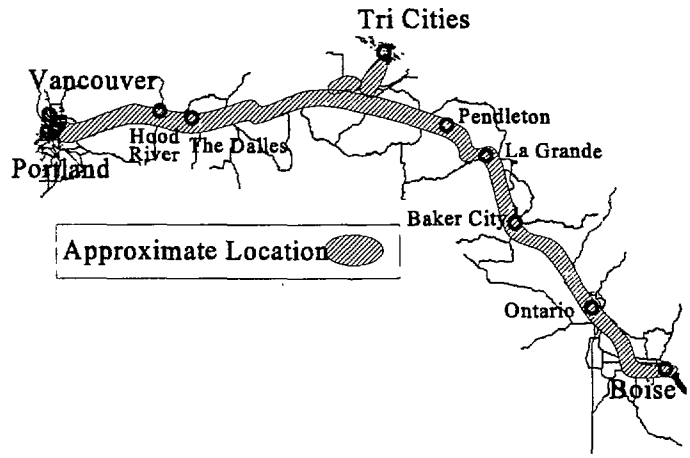
Medium Term: 2003 - 2007

7.1 Highway Advisory Radio Deployment in Corridor

Route Name: I-84, I-82, SR 14
Direction: Eastbound, Westbound
Beginning Mile Post: N/A
Ending Mile Post: N/A

Corridor Deficiency

Rain, snow, and ice related accident rates are a problem in many locations in the corridor. Other weather related problems, including high wind and fog sometimes require the freeway to be closed during the year. VMS equipment is highly effective at alerting drivers of roadway conditions but it is not capable of transmitting lengthy messages. There is a need to provide more real-time weather and roadway information to motorists. Some weather data is available from commercial stations located in the corridor but most motorists don't want to wait for long periods of time to get the information.



ITS Solution

Deploy Highway Advisory Radio equipment (HAR) near VMS locations. The VMS can alert drivers to the general problem and then drivers can tune to the HAR to obtain greater details regarding the roadway segment ahead. Messages could be automatically generated by the RWIS or created manually when necessary. In the long term eventually, convert the HAR system to a Radio Broadcast Data System (RBDS) where digital messages are directly sent to vehicles through a FM sideband signal carried by a local radio station. With this technology, messages regarding accidents, weather problems, closures, etc. can be sent to RBDS radios regardless of the receiver's operational mode. Although this technology is relatively new to America, nearly 90% of vehicles in Europe have radios that can receive the digital messages. At this time only about 1 million vehicles in America have RBDS radios but car manufacturers are planning to include them as standard equipment. By 1998, General Motors plans to include them in all their vehicles. *Development of RBDS in America is ongoing. If the technology is sufficiently developed by the time HAR deployment is expected in the corridor, it may be desirable to immediately deploy RBDS without installing HAR as a precursor system.*

Safety Benefits

- Motorists will be better informed about hazardous weather conditions and can adjust their driving accordingly.
- Accidents in the corridor are expected to decrease.

Implementation Barriers

- Users must have access to a personal computer with an Internet provider or access a display at a field site.
- The information must be real-time.
- Information kiosks or display terminals need to be able to withstand possible vandalism.

Opportunities for Public/Private Partnership

- A commercial partnership may be possible for HAT whereby people listen to a brief commercial message and then access free weather information.
- Radio stations and television stations would be interested in having access to the weather and roadway condition information.
- Corridor information/data may be available from private or public sources/monitoring stations such as the National Weather Service or within the ITD, ODOT, and WSDOT.

Estimated Time of Deployment

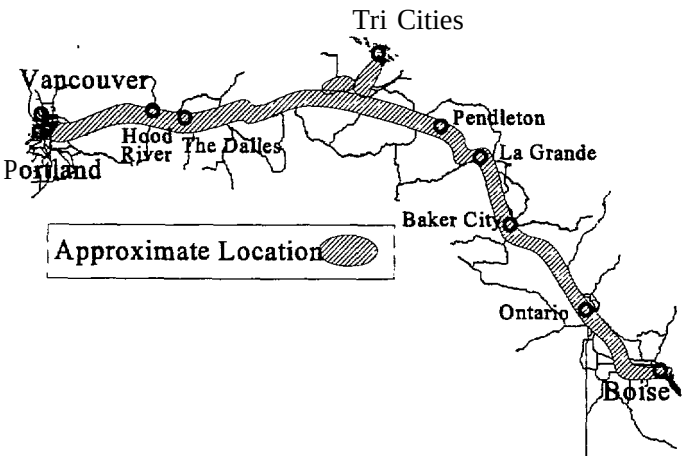
Short term: 1997 - 2002

7.3 Idaho, Oregon, and Washington ITS Deployment Coordination

Route Name: **I-84, I-82, SR 14**
Direction: Eastbound, Westbound
Beginning Mile Post: **N/A**
Ending Mile Post: **N/A**

Corridor Deficiency

With the deployment of ITS technologies in the corridor there is a need for better interagency coordination of information to ensure procedures, protocols, and equipment is compatible.



ITS Solution

The states should establish a working committee that can address the coordination and compatibility issues. Elements that need to be addressed include the following:

- Compatibility with National Traffic Control/IVHS Communications Protocol (NTCIP). The NTCIP is intended to define communications protocol for interfacing between traffic control equipment of all types and other devices that may be a part of a traffic management system
- A master communications plan between the three states. Currently, communications equipment is not compatible.
- Compatibility with existing ATMS systems and plans such as Portland's developing system.
- Locations of the central operations centers. The logical locations will be at sites where there are already 24 hour operations. Sites in Portland, Vancouver, and Boise should be considered.
- Software platform for the system. Should it be UNIX, Windows NT, others, etc. Oregon and Washington are moving toward NT as their standard.
- System security. ITS systems operated by the states need to be able to share information but maintain a high level of security. States need to have the ability to view data from other systems but also need to be able to "push" their information to other systems to ensure the timely transfer of data.
- System liability. Detailed message protocols for signs and other ITS equipment should be established to ensure that the messages with the highest importance are transmitted to the motorists.

Benefits

- Allows information to be freely shared between the three states.
- Ensures that equipment will have the ability to "talk" to each other.

- More cost-effective to share infrastructure than to create three independent systems.

Technology Requirements

Not applicable

Implementation Barriers

- Requires a commitment of all three states to actively pursue this objective together.

Opportunities for Public/Private Partnership

None identified

Estimated Time of Deployment

Short term: 1997 - 2002

8.0 Deployment Priorities

Technical Advisory Committee meetings were held in Ontario, Oregon on June 13, 1996 and in The Dalles, Oregon on June 14, 1996. At the meetings, corridor strategies were discussed and prioritized by the committee members. Based upon the discussions, several strategies were identified as having a high priority. They are described in order of priority below:

Road Weather Information System (RWIS)

Deploy road weather information system (RWIS) sites along identified sections of the corridor. Weather stations will assist road maintenance crews in deciding when plowing, sanding, or deicing chemicals should be implemented, as well as if travel should be restricted due to inclement weather, wind, or poor visibility. Weather stations could be spaced as close as five to seven miles in areas with the greatest weather and accident problems. Equipment could be spaced much further apart in other areas. The stations could monitor humidity, temperature, wind, precipitation, and visibility. As part of the RWIS, include low-cost, "still frame" video equipment to verify the weather conditions. The video image would assist people in determining the type of precipitation and the visibility. Make the information available to maintenance personnel at their maintenance facilities and at homes with a personal computer and pagers. Make information available to the general public through the Internet, kiosks, and Highway Advisory Telephone (HAT). Currently the weather information is very detailed. Before providing the information to the public, the data will need to be simplified. Information should also include details about construction and maintenance activities in the corridor.

Trip Information Systems

Create an Internet page or electronic mail message that provides corridor information on weather conditions, incidents, diversions, closures, maintenance, and construction activities. Even information such as parking lot occupancies at popular tourist sites, trail conditions. campgrounds. and wind speed information for surfers could be made available. This information would be accessible from any personal computer through an Internet connection. The information could also be made available at auto rental agencies. restaurants. motels. gas stations. truck stops. ports of entry, weigh stations. rest areas, kiosks, or other locations. The information could also be available from Highway Advisory Telephone (HAT) or a "broadcast fax" system to multiple sites.

Interagency Coordination and Equipment Standardization

The states should establish a working committee that can address the coordination and compatibility issues. Elements that need to be addressed include the following:

- Compatibility with National Traffic Control/IVHS Communications Protocol (NTCIP)
- A master communications plan between the three states
- Compatibility with existing ATMS systems and plans
- Software platform for the system
- System security
- System liability

Variable Message Signs

Deploy variable message signs (VMS) connected to the road weather information system (RWIS) sites. Use the VMS to convey to motorists weather information, road closures, traffic diversions, construction and maintenance activities. In the summer when weather related problems diminish, VMS equipment could be used to notify drivers of congestion associated with tourist attractions such as Multnomah Falls. Tie the operation to a central location where congestion, incidents, and other roadway information can be coordinated between the three states. VMS equipment should be located in advance of river crossings for maximum benefit to handle diversions. VMS operation could be relatively automated but may be overridden manually if needed. Remote VMS terminals could be allowed to control the sign messages as long as users have system authorization and the message conforms to the priority protocol. As state police begin outfitting patrol vehicles with computers, officers can provide real-time information regarding weather, closures, and diversions. It may be desirable to use the VMS to indicate to drivers the estimated length of the time to clear the incident, thus allowing drivers to alter their schedule or route.

Truck in Tunnel Detection System

Provide real-time enroute driver information to increase awareness of the potential for conflict in the SR 14 tunnels. Install signs with beacons in advance of the tunnel portals to alert drivers when large vehicles are in the tunnels. Signs could also be used to warn of bicycles. A truck height detector would be required to activate the sign.

Truck Oversize/Weight Detection System for Bridges

Deploy truck weight. height, and width detectors near the approaches to the bridges at Cascade Locks, Hood River and at The Dalles Have the detectors activate a warning sign to alert truckers that they cannot use the bridge.